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МЕТОДИКА ВИКОРИСТАННЯ ІНСТРУМЕНТІВ ГЕНЕРАТИВНОГО ШІ У ПРОЦЕСІ ІНШОМОВНОЇ ПІДГОТОВКИ СТУДЕНТІВ ТЕХНІЧНИХ СПЕЦІАЛЬНОСТЕЙ

Статтю присвячено обґрунтуванню та розкриттю методичних особливостей інтеграції інструментів генеративного штучного інтелекту (GenAI) в освітній процес вищої технічної школи. Актуальність дослідження зумовлена стрімким розвитком великих мовних моделей (LLMs) та потребою модернізації іншомовної підготовки студентів немовних ЗВО відповідно до вимог цифрового суспільства. У роботі здійснено ретроспективний аналіз еволюції комп’ютерно-орієнтованого навчання мов (CALL) від статичних мультимедійних систем до сучасних інтелектуальних екосистем.

Досліджено трансформацію структури професійних якостей майбутнього інженера та введено в науковий обіг поняття іншомовно-цифрової компетентності, компонентами якої визначено лінгвістичну, промпт-компетентність та критично-аналітичну здатність до верифікації даних. Здійснено типізацію та класифікацію провідних дидактичних функцій інструментів штучного інтелекту (текстово-аналітичної, продуктивно-генеративної, комунікативно-імітаційної та діагностично-корекційної), а також розроблено функціональну матрицю використання моделей ChatGPT, Gemini та Claude за видами мовленнєвої діяльності у межах інженерного дискурсу.

У роботі представлена трикомпонентна методична модель взаємодії «викладач – студент – ШІ-асистент», яка охоплює передтекстовий (проектування промптів), інтерактивно-генеративний (взаємодія з ШІ-тьютором) та пост-генеративний (критичний аудит і усна верифікація) етапи. Окреслені ризики впровадження GenAI в освіту, зокрема загрози академічній доброчесності, та запропоновано комплекс інноваційних рішень для реформування системи оцінювання знань через зміщення фокусу контролю з результату на процес діяльності студентів.

Ключові слова: *генеративний штучний інтелект, іншомовна підготовка, студенти технічних спеціальностей, промпт-інжиніринг, CALL, іншомовно-цифрова компетентність, академічна доброчесність.*

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METHODOLOGY OF USING GENERATIVE AI TOOLS IN THE PROCESS OF FOREIGN LANGUAGE TRAINING OF ENGINEERING STUDENTS

The article is devoted to the substantiation and disclosure of methodological features of integrating generative artificial intelligence (GenAI) tools into the educational process of higher technical schools. The relevance of the study is driven by the rapid development of large language models (LLMs) and the need to modernize the foreign language training of non-linguistic university students in accordance with the demands of the digital society. The paper provides a retrospective analysis of the evolution of computer-assisted language learning (CALL), tracing its path from static multimedia systems to modern intelligent ecosystems.

The transformation of the structure of a future engineer's professional qualities has been investigated, and the concept of "foreign language-digital competence" has been introduced into scientific discourse. Its core components are defined as linguistic competence, prompt competence, and critical-analytical data verification ability. The study offers a typologization and classification of the leading didactic functions of AI tools (textual-analytical, productive-generative, communicative-imitative, and diagnostic-corrective) and develops a functional matrix for utilizing ChatGPT, Gemini, and Claude models across different language skills within engineering discourse.

The paper presents a three-component methodological model of "teacher – student – AI-assistant" interaction, which encompasses pre-textual (prompt design), interactive-generative (interaction with an AI tutor), and post-generative (critical audit and oral verification) stages. The risks of implementing GenAI in education, specifically threats to academic integrity, are outlined, and a set of innovative solutions for reforming the knowledge assessment system is proposed by shifting the focus of control from the final product to the students' learning process.

Key words: *generative artificial intelligence, foreign language training, engineering students, prompt engineering, CALL, foreign language-digital competence, academic integrity.*

Problem Statement and Substantiation of Its Importance. The transformation of the higher technical education system in the context of the rapid development of generative artificial intelligence (AI) directly correlates with the strategic priorities of Ukraine's state policy. Specifically, the National Strategy for Education Development in Ukraine emphasizes the need for a radical modernization of learning content and formats based on the latest digital technologies, ensuring individualized educational trajectories for learners, and fostering their skills of the future.

At the same time, the guidelines for integrating intelligent systems into the educational space are clearly outlined in the Concept of Artificial Intelligence Development in Ukraine. This regulatory legal document defines the educational sector as one of the key vectors for implementing AI technologies, emphasizing the importance of improving the quality of specialist training, automating routine educational processes, and developing the digital competence of both educators and students.

Furthermore, within the context of European integration processes and in view of the provisions of the Law of Ukraine "On Higher Education", foreign language training for engineering students involving GenAI tools serves as a fundamental prerequisite for enhancing the international competitiveness of domestic higher education. It facilitates the integration of future engineers and IT specialists into the global research and production space. Thus, the development of a scientifically substantiated methodology for utilizing generative AI is a logical step toward implementing state educational and technological standards.

A special place in this process belongs to foreign language training, which is transforming from a subsidiary discipline into a strategic tool for shaping the international academic and professional mobility of future specialists. The emergence and mass proliferation of generative artificial intelligence (GenAI) tools, such as large language models (LLMs) like ChatGPT, Claude, Gemini, etc., have drastically changed the didactic landscape. Technical students, being the most adaptive to digital innovations, are already actively and autonomously utilizing AI technologies in their daily learning activities.

However, a significant contradiction has emerged in pedagogical practice: on the one hand, generative AI possesses tremendous linguodidactic potential for individualizing learning. On the other hand, traditional foreign language teaching methodologies in higher technical educational institutions (HEIs) have proved not fully prepared for the controlled, methodologically substantiated, and safe integration of these tools into the educational process. The unregulated nature of this issue leads to risks of declining academic integrity and cognitive passivity among students. Consequently, there is an acute need for theoretical substantiation and the development of a holistic methodology for using generative artificial intelligence as a legitimate and effective assistant in the process of foreign language training.

The relevance of the outlined problem is driven by a number of factors of both global and domestic nature:

- **Technological factor:** Generative AI demonstrates an unprecedented level of natural language proficiency, the ability to model authentic professional contexts, provide instant error analysis (feedback), and adapt textual material to the individual level of the learner. Ignoring these tools in higher education is impossible, while their uncontrolled, spontaneous use by students neutralizes the pedagogical efforts of the instructor.
- **Specificity of the technical profile:** Students of engineering, economic, and IT specialties possess a high level of digital literacy but often face a lack of motivation to study humanitarian disciplines and experience psychological barriers during foreign language communication. AI tools allow for shifting the focus from mechanical memorization to solving applied, quasi-professional tasks in English (e.g., writing technical documentation, simulating negotiations with foreign clients), which significantly increases student engagement.
- **Labor market requirements:** Modern specialists in technology engineering, electrical engineering, and electronic communications must not only possess English language proficiency at the B2 level (in accordance with the Law of Ukraine "On Higher Education" and ECTS requirements) but also skills for effective interaction with artificial intelligence (prompt engineering). The combination of foreign language and artificial intelligence competences makes a graduate of a technical HEI competitive in the international labor market.
- **Socio-pedagogical context:** Under the conditions of forced distance and blended learning in

Ukraine, the need for developing learner autonomy becomes highly relevant. In this context, generative AI is capable of performing the role of a round-the-clock personal AI Tutor, ensuring continuous language practice outside the classroom.

Thus, the development and implementation of a scientifically substantiated methodology for using generative artificial intelligence tools in the process of foreign language training for engineering students is a relevant and timely pedagogical task, the solution of which will contribute to the modernization of the content and formats of higher technical education.

Analysis of Recent Research and Publications. The problem of higher education digitalization, the integration of innovative computer technologies, and the use of artificial intelligence systems in the educational process is constantly at the center of attention of both domestic and foreign researchers. Aspects of computer-assisted language learning (CALL) have been developed in various directions. Thus, V. Bykov investigated models of open educational systems and learning environments, which became the basis for CALL. The issues of using information technologies specifically for students of technical non-linguistic HEIs were examined by M. Zhaldak, E. Polat, O. Morska, S. Amelina, and R. Kotsiuba.

Foreign scientists C. Chappelle, M. Levy, J. Higgins, T. Johns, G. Davies, and J. Burston investigated the effectiveness of CALL tools, computer learning methodology, conceptual links between linguistic theories and practical programming of educational resources, and the construction of CALL models for students of non-linguistic specialties.

The latest stage in the development of computer-oriented linguodidactics is associated with the direct implementation of artificial intelligence systems. The use of intelligent agents, chatbots, and natural language processing (NLP) to overcome the language barrier was investigated by Y. Goda, K. Shadiev, X. Lu and others. The peculiarities of educational space transformation under the influence of large language models (LLMs) and generative AI are highlighted in the works of K. Y. Ju, A. Martínez-Arboleda and other scientists. In the Ukrainian scientific space, the theoretical and methodical foundations of applying AI in education are being developed by S. Lytvynova, N. Morze, Yu. Trius, O. Striuk, N. Shakhovska, and others, while the applied aspects of using generative tools (specifically ChatGPT) in the process of students' foreign language training have become the subject of study by M. Umanets, O. Chernysh, Yu. Borysova, L. Ponomarenko, T. Ostrovska, O. Barabanova, O. Zubenko, and V. Kovalchuk.

The features of using GPT and Gemini tools for the development of academic writing skills and the creation of individualized language feedback were investigated by B. L. Moorhouse, K. M. Wong, J.-H. Woo, A. Steiss, as well as Lai and Lee. Scientists analyze the processes of student interaction with AI, the impact of this purposeful methodological interaction on the development of critical thinking and language autonomy, and compare the effectiveness of using text models (like GPT) versus voice AI agents for developing speaking skills and overcoming language anxiety. They also explore the capacity of models like GPT and Gemini to adequately assess language proficiency (according to the CEFR scale) and generate adaptive tests tailored to the student's current level.

However, despite the presence of fundamental works on the general digitalization of education, most existing studies are dedicated to the use of traditional information and communication technologies (Moodle platforms, mobile applications, web resources). The question of the didactic potential of generative artificial intelligence specifically (large language models like ChatGPT, Claude, etc.) in the process of teaching a professional foreign language to future engineers remains fragmented and theoretically unsystematized. Currently, there is a lack of holistic methodological systems that would regulate the step-by-step algorithm of interaction between a technical HEI student and GenAI, define criteria for academic integrity, and account for the specific characteristics of engineering discourse.

Considering the objective need of the practical sector of higher education and the insufficient level of theoretical development of the mentioned problem, **the purpose of our article** is to substantiate and disclose the methodological features of implementing generative artificial intelligence tools into the process of foreign language training of engineering students.

Main Body of the Research. The realization of the outlined research purpose requires, first and foremost, a conceptual rethinking of the structure and content of professional training for future technical specialists. In the era of the Fourth Industrial Revolution (Industry 4.0) and the rapid implementation of generative artificial intelligence, foreign language training for students of non-linguistic HEIs cannot be limited to the traditional study of lexical and grammatical material. The present day demands the formation of a synergetic construct – foreign language-digital competence, where language knowledge is integrated with the mastery of high-tech tools.

The theoretical foundation for understanding this process is the concept of a computer-oriented learning environment developed by academician V. Bykov, who emphasizes that the transformation of education must occur through the creation of open information-educational systems that change the very paradigm of interaction between learning subjects [1]. Concreteizing these ideas for linguodidactics, researcher O. Morska proves the need to design learning models where digital technologies act not merely as a technical means of visualization, but as a cognitive tool for developing foreign language skills [3].

In the context of the emergence of large language models (LLMs), the concept of an engineer's foreign language competence expands significantly by including the component of prompt engineering into its structure. As foreign researcher L. Kohnke notes, in modern realities, the English language has de facto transformed into the "programming language of artificial intelligence," since generative models (such as ChatGPT or Gemini) deliver the highest quality, most accurate, and contextually adequate responses precisely when queries are formulated in English [8]. Consequently, a student's ability to clearly, logically, and grammatically correctly construct prompts (instructions for AI) within their field of study is direct evidence of their professional foreign language literacy.

Ukrainian researchers L. Ponomarenko and T. Ostrovska demonstrate in their works that for students of technical and IT specialties, foreign language training must acquire a clearly defined instrumental character [4]. Artificial intelligence in this process becomes a catalyst

that allows for shifting the emphasis from mechanical memorization of terminology to solving applied, quasi-professional tasks. According to O. Zubenko, the integration of GenAI into teaching English for Specific Purposes (ESP) enables the formation of so-called "adaptive language autonomy" in students, where the learner learns to independently model the foreign language professional environment and manage it using AI agents [2].

Thus, the modern structure of foreign language training for engineering students using GenAI tools should be based on three interconnected components:

1. Linguistic (mastery of the professional terminology system and grammatical structures);
2. Technological / Prompt-competence (the ability to manage the query architecture for ChatGPT, Gemini, and Claude models);
3. Critical-analytical (the ability to verify, edit, and post-process the foreign language content generated by AI).

The effectiveness of the developed methodology directly depends on the rational distribution of didactic functions among modern generative models (ChatGPT, Gemini, Claude) in accordance with their architectural advantages and the specific characteristics of language skills. As American researcher R. Godwin-Jones aptly notes, the integration of large language models (LLMs) into linguodidactics transforms the classical concept of computer-assisted language learning (CALL) due to the transition from static text bases to a dynamic and contextually flexible language ecosystem [6].

In the process of foreign language training for engineering students, it is advisable to distinguish four main didactic functions of GenAI tools:

1. **Textual-analytical function (Receptive activities: Reading and Listening).** The specificity of teaching English for Specific Purposes (ESP) in a technical HEI involves working with large volumes of complexly structured scientific and technical content. Models with a large context window (specifically, Google Gemini and Claude) demonstrate high efficiency in the processes of summarization and extraction of core knowledge. According to a study by Korean scientist J.-H. Woo, using LLMs to adapt and simplify authentic technical texts (e.g., specifications or patents) without losing terminological accuracy allows for implementing the principle of learning accessibility for students with different levels of foreign language proficiency (from A2 to B2) [10].

2. **Productive-generative function (Productive activity: Writing).** The formation of an engineer's professional written communication skills (writing supporting documentation, bug reports, business letters, scientific abstracts) is traditionally accompanied by a high level of anxiety. Using ChatGPT as an AI Writing Assistant allows for implementing the method of modeling and paraphrasing. Researchers B. L. Moorhouse and K. M. Wong prove that generative models are capable of acting as a tool of "linguistic scaffolding", helping students transform basic ideas into academically and professionally refined textual forms [8].

3. **Communicative-imitative function (Productive activity: Speaking).** One of the most difficult problems of foreign language training in non-linguistic universities is the lack of an authentic language environment for developing oral language competence. The emergence of multimodal features, such as voice modes (Advanced Voice Mode in ChatGPT, Gemini Live), enables the function of an individual conversation partner. Conversational AI agents effectively lower students' affective barriers. AI allows for simulating real quasi-professional situations – such as passing a technical interview (Mock Interview) or pitching an engineering project (Project Pitch) under conditions free from the fear of making a mistake.

4. **Diagnostic-corrective function (Automated Feedback).** In the traditional educational process, the instructor is limited in their ability to provide instant, individualized error analysis to every student. GenAI models resolve this problem through the Automated Writing Feedback function. As A. Steiss demonstrates in her empirical experiments, generative AI provides not only the correction of orthographic or grammatical flaws in students' technical texts, but also offers detailed linguistic explanations in real time, which stimulates student reflection and self-correction [9].

Summarizing the didactic toolkit, it is appropriate to present the matrix of the functional use of GenAI in the foreign language training of specialists in civil, computer, and electrical engineering, technology engineering, and mechatronics in the form of a table:

Table 1. Matrix of GenAI Functional Application in Engineering ESP

Language Skill	Preferred GenAI Tool	Methodological Task (Quasi-professional Context)	Didactic Outcome
Reading	Google Gemini / Claude	Summarization of English IT manuals, extraction of terms.	Rapid semanticization of professional text.
Writing	ChatGPT / Claude	Drafting technical documentation, business emails to clients.	Mastery of professional writing genres.
Speaking	ChatGPT (Voice Mode)	Simulating Daily Stand-up meetings, technical interviews.	Overcoming psychological barriers, developing fluency.
Language Assessment	ChatGPT / Gemini	Request for a linguistic audit of one's own text according to the CEFR scale.	Formation of language self-correction skills.

Thus, the didactic palette of generative artificial intelligence demonstrates its multi-functionality. However, the spontaneous use of these models threatens a regression of language autonomy, which highlights the need to develop a clear pedagogical algorithm of interaction.

The practical realization of the didactic potential of GenAI requires the construction of a clear methodological model. The traditional two-component scheme of "teacher – student" interaction is transformed under modern conditions into a triangle: "teacher – student – AI-assistant". The main task of this model is to transform the use of artificial intelligence from a spontaneous tool for quick cheating into a legitimate and controlled means of the learner's cognitive development.

Researcher O. Chernysh aptly notes that the linguodidactic potential of intelligent systems is revealed most fully during the optimization of students' autonomous and classroom work, where AI plays the role of a flexible trainer, but under compulsory conceptual control by the educator [5].

To systematize this process, we have developed a three-stage algorithm of interaction between the subjects of learning, adapted to the specific nature of technical discourse (using the task "Drafting and Presenting a Technical Report for an Engineering Project" as an example):

Stage 1. Pre-textual / Design (Input & Prompting). At this stage, the leading role belongs to the instructor, who defines the didactic goal, evaluation criteria, and the boundaries of AI use. The student acts as a "prompt engineer." Instead of a direct request like "write a report," the student, under the instructor's guidance, constructs the architecture of the query (system prompt), setting the role model and limitations.

Prompt Example: "Act as a senior automation engineer. Analyze the architecture of this system (basic description provided in Ukrainian or in bullet points in English) and help me draft the structure of a technical report in English. Use exclusively a formal business style and IEEE terminology."

Stage 2. Interactive-generative (Interaction & Generation). This stage is completely autonomous and takes place within the "student – AI" interaction (personal AI tutor). The student conducts a dialogue with the model, step-by-step filling out the structure of the report. AI generates phrasing options, suggests synonyms for technical terms, and corrects the grammatical constructions of the student.

Student's Activity: Requests explanations regarding the use of specific vocabulary (e.g., the difference between device, apparatus, and appliance in a specific context), asks to simplify or, conversely, make sentences more academic. At this stage, an intensive immersion into the language material occurs through the interactive interface.

Stage 3. Post-generative / Critical-analytical (Critical Evaluation & Human Feedback). The most crucial stage that prevents "cognitive passivity" and protects academic integrity. The text received from the AI is not a final product. The student is obliged to conduct a critical audit of the generated material.

- Text Verification: The student checks the text for the presence of "factual hallucinations" by the AI, and cross-checks technical terms with current standards (ISO/DSTU).
- Instructor's Control: The final defense of the work takes place exclusively within the "student – teacher" interaction. The student presents the report orally and must be ready to explain the choice of any lexical unit or grammatical structure suggested by the AI. What is evaluated is not the mere fact of having the text, but the student's ability to operate with it and justify the logic of its construction.

The proposed algorithm allows for turning work with large language models into a conscious learning process, where artificial intelligence takes upon itself the routine function of a linguistic reference book, while the student focuses on analytical activity, critical thinking, and professional communication.

The mass implementation of generative artificial intelligence tools into the educational process of a technical university, alongside obvious didactic benefits, brings forward a number of significant challenges and risks. The most acute among them are the threat of declining academic integrity (uncontrolled copying of generated content), the formation of "cognitive passivity" in students (loss of skills for independent information retrieval and analysis), as well as the problem of AI "hallucinations" – the production of factually unverified or false data, which is critical for the engineering field.

To mitigate these risks, the classical system of evaluating the results of foreign language training in higher technical schools requires a radical overhaul. If previously the instructor evaluated mainly the final product of the student's activity (a written essay, a completed test, a prepared paper), under conditions of free access to ChatGPT or Gemini, such an approach loses its diagnostic value, since any textual artifact can be created by artificial intelligence in a matter of seconds.

Consequently, it is proposed to shift the focus of control from the product to the process of activity of the students, which involves the implementation of the following methodical solutions:

- Prompt-Log Assessment: Along with the completed foreign language assignment, the student is required to provide a printout or a link to the working chat history with the AI. The instructor evaluates the quality of prompt engineering: how logically the student built the queries, how they reacted to the model's errors, and what clarifying instructions they used. This allows for verifying the course of the learner's analytical thinking.
- The "Critical Audit" Method (AI-Editor Role): The student is intentionally asked to give a task to the AI and then analyze the generated text in written or oral form. The grade is awarded based on the number of linguistic or technical inaccuracies found, the suggested term replacements, and the substantiation of why this specific option is more appropriate for engineering discourse.
- Dominance of Oral Verification (Oral Defense): Any written report, technical specification, or presentation performed with the help of GenAI is a subject to mandatory oral defense (either directly in class or via synchronous video communication tools). The instructor conducts a rapid interview based on the text, where the student must demonstrate a full understanding of the vocabulary, syntax, and abbreviations utilized by the AI.

Thus, the solution to the problem of academic integrity does not lie in the plane of total prohibitions of artificial intelligence, which is impossible in a modern digital society, but in a change of the philosophy of control. Legitimatizing GenAI as an official "working assistant" while simultaneously making the procedure of defending assignments more rigorous allows for maintaining a high level of learning motivation among engineering students and ensures the transparency and

objectivity of evaluating their actual foreign language knowledge.

Conclusions and Prospects for Further Research. The rapid evolution of artificial intelligence systems has led to the transformation of the classical foreign language competence of a future engineer into a complex construct – foreign language-digital competence. Its architectural core, in addition to language knowledge, consists of prompt competence and the critical-analytical ability to verify generated content.

In this study, we conclude that a rational distribution of tasks between models (ChatGPT, Gemini, Claude) allows for fully satisfying the needs of technical profile students within authentic professional contexts: from the summarization of technical documentation to the simulation of engineering interviews. Furthermore, the three-stage interaction algorithm of "teacher – student – AI-assistant" makes it possible to turn artificial intelligence into a controlled personal tutor, where routine operations are delegated to the neural network, while the student focuses on higher cognitive processes and the oral foreign language defense of their own solutions.

Prospects for further research consist in conducting a long-term pedagogical experiment aimed at the empirical verification of the developed methodology's effectiveness, as well as in studying the specific aspects of using narrow-specialized AI agents for students of concrete engineering directions (such as robotics, civil engineering, or cybersecurity).

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ВІДОМОСТІ ПРО АВТОРА

ГАВРИЛЕНКО Ольга – кандидат педагогічних наук, доцент, доцент кафедри міжнародних економічних відносин та іноземних мов Центральноукраїнського національного технічного університету.

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